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FIRM SIZE AND REGIONAL LINKAGES. A TYPOLOGY OF
MANUFACTURING ESTABLISHMENTS IN SOUTHERN SPAIN

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Regions with different levels of development are characterized by
different enterprise compositions according to firm size and regional productive
linkages. Using these two variables and two additional ones -the technological
level and the position in the value chain-, the composition of the industrial sector
in any region can be studied. In this respect, a new theoretical enterprise
typology is proposed in this paper as a powerful analytical tool. Furthermore, an
empirical work is carried out using a data set from the survey done to estimate
the regional input-output table of Andalusia, a backward region in southern
Spain. Thus, the theoretical enterprise typology is applied to the industry in

Andalusia, so that some strengths and weaknesses of the regional economy are identified.

Key words: input-output; forward and backward linkages; firm size; SME; large enterprises; microenterprises.

JEC: L25, D57, R15.

1. INTRODUCTION

Productive linkages between firms and sectors within a specific spatial area have always been considered a source of static and dynamic externalities which encourage economic growth. These linkages can be studied at different levels of aggregation, depending on which unit of analysis is chosen: the activity sector or the firm. In both cases, the use of input-output models and accounts represents a powerful methodological approach.

In the first case, there is a vast literature conceived at meso-economic level, as a focus on sectors and inter-sectoral linkages. In this respect, since the seminal works of Leontief, economists have extensively employed input-output techniques to study the production structures of national or regional economies (RASMUSSEN, 1956; FESER and BERGMAN, 2000; DIETZENBACHER *et al.*, 2005). In the second case, many authors have studied linkages from a microeconomic point of view, considering buyer-supplier relationships between firms located within a territory, generally a local area. The whole literature regarding industrial districts or local production systems could be included in this group (MARSHALL, 1890; BECATTINI, 1979). Also, at this level, input-output models have been developed to study physical or monetary flows within an industrial district (see, for instance, ALBINO *et al.*, 2003). Finally, many

works consider the internal transactions among different departments or units within an individual firm such as intra-firm linkages and apply enterprise input-output models and accounts to its analysis (see LIN and POLENSKE, 1998 for a review).

In this paper we propose a new analytical framework combining these levels of analysis to study the relationship between firm size and the spatial structure of linkages. In this respect, it is frequently believed that SMEs, in comparison to large enterprises, have stronger linkages with local or regional suppliers and clients. Nevertheless, the internationalization process of SMEs and the changes in large firms' organization in recent decades might be modifying these traditional assumptions. In any case, the relationship between firm size and regional linkages is more complex than what these generalized statements show. In order to more thoroughly explore this issue, we propose an original enterprise typology based on the spatial structure of inter-firm linkages, which distinguishes different enterprise models with different roles within the regional productive system. This typology can be a powerful tool to identify the strengths and weaknesses of a regional economy.

In addition, we carry out an empirical analysis, using a data set of 29 manufacturing sectors from the regional input-output table of Andalusia (IEA, 1999), a backward region in southern Spain. With respect to this, the novelty of the approach lies in the fact that we do not work with data for sectors, as input-output tables traditionally do, but with data disaggregated into groups of firms *within each sector* according to their size, in terms of number of employees. This disaggregated data allows us to illustrate our methodology, analysing the productive structure of industry in Andalusia.

The paper is organized as follows. Section 2 reviews the literature considering the importance of productive linkages and the impact of firm size on them. In Section 3, we propose our theoretical enterprise typology. In Section 4, we apply the enterprise typology proposed in Section 3 to the industrial sector in Andalusia. Finally, Section 5 concludes the paper.

2. FIRM BEHAVIOUR AND PRODUCTIVE LINKAGES. A LITERATURE REVIEW

Many authors have stressed the importance of linkages between sectors and firms as a source of externalities which improve economic performance (MARSHALL, 1890; HIRSCHMAN, 1958; LEONTIEF, 1966). Furthermore, the impact of the linkages has been reconsidered more recently from several economic streams.

2.1. Rethinking the linkages

Firstly, the endogenous growth models have emphasized the role of certain dynamic externalities –the technological spillovers– as a source of increasing returns. In these growth models, though the production of individual firms shows constant returns to scale, there are socially increasing returns due to the external effects arising from the individual firms' investment, especially in technological and human capital (ROMER 1986; ROMER, 1990). Thus, the diffusion of knowledge resulting from the firm's investment increases the efficiency in the whole economy. Regarding this, considerable empirical evidence supports the hypothesis that these effects appear more frequently in diversified productive systems due to a cross-fertilization among sectors (GLAESER *et al.*, 1992; HENDERSON, 1994). Hence, it is reasonable to

believe that productive linkages are a probable route for these external effects. In this way, technological spillovers have been studied, in one of the methodological alternatives developed, applying input-output tables (VERSPAGEN and DE LOO, 1999; DIETZENBACHER and LOS, 2002).

Although productive linkages have always been present in spatial economics (see, for instance, STREIT, 1969), the ‘New Economic Geography’ models have recovered some former ideas of Marshall and Hirschman with a new perspective. In this sense, many authors have introduced classical backward and forward linkages in formalized models as relevant factors in the spatial dynamic of the productive activity (KRUGMAN, 1991; FUJITA *et al.*, 1999). Thus, productive linkages are viewed as a type of externality that can lead to agglomeration economies when they are subject to a spatial constraint (PARR, 2002; PARR *et al.*, 2002).¹

Finally, the economical impact of the externalities associated with the linkages has been broadly considered in the ‘Endogenous Development’ literature, which defends a development strategy from below based on the local assets and entrepreneurial initiatives (GAROFOLI, 1992; VÁZQUEZ, 2002). Regarding this, the literature about industrial districts, local systems of firms and clusters has stressed the role of linkages and cooperation between firms within an area (BECATTINI, 1979; PYKE *et al.*, 1992; MARKUSEN, 1996; PORTER 1998; GUERRIERI *et al.*, 2001). This authors has also paid attention to the local production models organised around large enterprises, pointing out the importance of linkages between large firms and indigenous SMEs that act as their suppliers (VÁZQUEZ, 1999; RUTHERFORD, 2000).

2.2. Firm size, productive linkages and enterprise models

In comparison to large enterprises, it is frequently supposed that SMEs show a higher level of territorial integration and maintain stronger linkages with local or regional suppliers and clients (FLORIO, 1996, CRONE and WATTS, 2000; GÖRG and RUANE, 2001). Nevertheless, you can also often find dynamic SMEs, which operate with external suppliers and export a high proportion of their production, actively participating in the globalization process (ACS and YEUNG, 1999; AUDRETSCH, 2003; ETEMAD and WRIGHT, 2003; JONES and DIMITRATOS, 2004).

On the contrary, it is commonly believed that large enterprises frequently have more intense linkages with productive units located outside the region than with firms operating in the same area. The extreme case of this productive behaviour is the model of 'industrial enclave'. The enclave industry operates in a backward territory developing specific phases of a complex production process. The intermediate inputs required are purchased externally and the output is used in subsequent manufacturing activities in plants located in other territories. Normally, this type of firm features a limited economic impact in the area in the short and in the long run, and it even might distort the resource allocation at local or regional level (DELGADO, 1981; BARROW and HALL, 1995; HARDY, 1998; O'HEARN, 2001).

However, changes in the organization of large enterprises in recent decades have led them to give up the functional strategies, according to which the territory was seen as a mere physical base of the firms' plants. On the contrary, large corporations in some sectors are adopting territorial strategies so that, nowadays, they often procure to integrate themselves into local and

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4 regional environments. This transformation in large enterprises has stimulated
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6 the decentralization of non-nuclear activities towards SMEs and the
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8 intensification of the linkages with local SME clusters. Large corporations in
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10 some sectors thus tend to set up their establishments in dynamic areas where
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12 they can exploit external economies and benefit from high quality resources and
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14 the presence of specialized suppliers. This model of a large enterprise that is
15
16 more integrated in the territory has become increasingly more important in
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18 recent decades, especially in some high-tech and knowledge-intensive sectors.
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20 This type of company participates more actively in the technical, social and
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22 economic interactions within the territory where they operate, and their forward
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24 or backward linkages with other firms within the area can be a source of static
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26 and dynamic externalities (PIORE and SABEL, 1984; BARROW and HALL,
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28 1995; BELLANDI, 2001; VÁZQUEZ, 2002).²
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35 To conclude, forward and backward linkages between firms and
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37 industries have important effects on the localization and efficiency of productive
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39 activity. Although multiple factors play a role, the spatial structure of linkages is
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41 finally determined by firms' decisions. Since firm size conditions the firm's
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43 strategic policy, a different composition of the productive system in terms of firm
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45 size will lead to different spatial patterns of linkages. Furthermore, since
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47 linkages represent economies external to the firm, there is no guarantee that
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49 the optimum for each enterprise would lead to an optimum for the whole
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51 productive system in a region. Consequently, it is interesting to analyse the
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53 regional structure of productive linkages and to check whether potential
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55 linkages are being well-exploited or not, considering the consequences for the
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57 regional economy in terms of efficiency. For this purpose, it would be
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convenient to have at our disposal an exhaustive typology of enterprises as an analytical tool. With this in mind, on the one hand, we can find in the literature some examples of firm typologies which take into account the implications for regional development, though they are not strictly focused on productive linkages (see, for instance, Young *et al.*, 1994, regarding multinational enterprises, or Cooke *et al.*, 2005, for SMEs). On the other hand, as we have previously pointed out, certain authors have identified some models of firms characterized by specific spatial patterns of linkages (for example, PIORE and SABEL, 1984; BARROW and HALL, 1995; HARDY, 1998; BELLANDI, 2001). However, they do not provide a systematic and global framework leading to a full enterprise typology.

3. FIRM SIZE AND SPATIAL PATTERNS OF LINKAGES. AN ENTERPRISE TYPOLOGY

In this paper, we propose an enterprise typology which identifies diverse patterns of firm behaviour within a regional productive system. The typology is based on two criteria: the location of suppliers and the location of sales markets. According to these variables, we can differentiate seven types or models of enterprises: the “domestic” firm, the “exporting” SME, the “dependent” SME, the “extravert” SME, the large “propelling” firm, the large “enclave” firm, and the large “market-orientated” firm. This classification can be represented graphically on an axis system (Figure 1), considering the localization of the suppliers (regional or external) on the abscissas axe, and the geographic orientation of sales (regional or external) on the ordinates axe.³

INSERT FIGURE 1 AROUND HERE

These enterprise models fulfil different functions within a regional productive system, so that each one has a different strategic relevance. Nevertheless, the role and the contribution of each enterprise model to the whole economy depend on several factors that are directly related to the type of sector in which they operate. For this reason, we will also consider a sector typology based on two factors: the position within value chains and the technological level. On the one hand, with respect to the first factor, we will differentiate three types of sectors:

- *Basic sectors*, whose production is essentially used as an input in other production processes. Due to their situation at the beginning of the production chains, these sectors might induce strong forward linkage effects.
- *Intermediate sectors*, which represent intermediate links in the production chains and, in consequence, might induce backward and forward linkage effects.
- *Final sectors*, whose output is essentially orientated to the final demand. Due to their situation at the end of production chains, these sectors might induce strong backward effects.

On the other hand, the technological level of the sector influences the appearance of spillover effects and the productivity of firms included in it. Regarding this, we will also distinguish three types of sectors: *high technological*, *medium technological* and *low technological* industries. By combining these two factors, nine types of sectors can be identified, as Table 1 shows.

INSERT TABLE 1 AROUND HERE

Finally, considering the two criteria and the sector classification, the seven enterprise models can be defined and valued as follows:

a) The 'domestic' firm is the production unit whose activity, as a result of the nature of the productive process and/or the business strategies developed, is limited to a regional area regarding its sales, as well as its input purchases. This firm behaviour can be observed frequently in SMEs and -no so often- in large firms, but it is especially characteristic of microenterprises. The domestic firm has not a significant external projection, which, from a macroeconomic perspective, reduces the capacity of this type of enterprises to propel the economic regional growth. However, these firms may contribute, especially in intermediate sectors, to internally interconnect the regional productive system through productive linkages which can represent a channel of static and dynamic externalities.

b) The 'dependent' SME is the small or medium-sized firm whose suppliers are mainly situated outside the region, and whose production is sold basically in the regional market. The net-importing performance of this type of SME increases the regional level of external dependency, and limits its impact through backward linkages. Consequently, this model of SME is not especially interesting from an endogenous development perspective, especially in low-tech final industries, where more value isn't added to the product in later transformation processes. In spite of this, they can have a more relevant function in high-tech and basic or intermediate industries in which they act as suppliers of other productive regional activities, participating in production

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4 chains that are, at least, partially endogenous. In these cases, they can
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6 contribute to improving the technological level and the productivity of other firms
7
8 associated with them through forward linkages.
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11 c) The 'exporting' SME is the small or medium-sized firm whose production is
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13 principally sold in external markets, but whose main suppliers are situated in the
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15 region where it is located. Its exporting potential, which reflects a high level of
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17 competitiveness, and its backward linkages within the regional productive
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19 system, provide this type of firm with a certain pulling power. Therefore, from a
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21 macroeconomic perspective, this model of enterprise contributes in a very
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23 positive way to regional growth, especially in final sectors, where there are not
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25 many other forward steps in the productive chains that could increase the
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27 added value and the employment within the region.
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32 d) The 'extravert' SME is the small or medium-sized enterprise whose activity is
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34 orientated towards external markets, with regards to the sale of its products as
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36 well as the purchase of its inputs. This type of enterprise shows an intense
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38 exporting activity, which enlarges its growth potential through the sales in
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40 external markets. However, the extravert SME has weak forward and backward
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42 linkages with other firms within its regional productive system. Consequently, it
43
44 doesn't generate significant pushing or pulling effects. Nevertheless, the
45
46 external supply of inputs may constitute a factor of competitiveness for these
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48 SMEs. In addition to this, the absence of relevant backward linkages doesn't
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50 significantly increase the risk of delocalization for this model of enterprises. The
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52 reason for this is that the ownership and the management of these firms are
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54 usually situated within the region, since the level of penetration of external
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capital in the SME sector tends to be far lower in comparison to the sector of large-sized firms.

e) The large 'propelling' firm is the corporation which has intense backward linkages with regional suppliers, but is essentially orientated towards external markets regarding its sales. This type of enterprise assumes an important role, especially in final sectors, encouraging the regional economic growth, thanks to its combination of external projection and backward integration into the regional productive system. Due to this strategic position, it may serve as a powerful engine for the regional economy, impelling the economic growth and the diffusion of innovations, especially in final or intermediate high technological industries.

f) The large 'enclave' firm is the corporation whose main suppliers are located outside the region and commercializes its products basically in external markets. The phenomenon of the industrial enclave is associated with the vertical integrated company, which sets up a subsidiary plant in a region to fulfil a specific function within the whole productive process. The inputs which this type of firm requires are produced in establishments of the same firm situated in other regions and the output is used -as an intermediate input or a component of the final product- in other plants of the same firm, also externally located. Therefore, the large enclave firm doesn't integrate within the regional productive system, which reduces its indirect impact on the regional economy. Furthermore, the absence of relevant backward and forward linkages increases the risk of industrial delocalization, particularly when the ownership and the management of these firms are external to the region –something quite usual in backward regions.

g) The large 'market-orientated' firm is the corporation whose location is explained by its proximity to the market, whereas its main suppliers are situated mainly outside the region. We can distinguish two types of large market-orientated firms:

- *External large market-orientated firms*, that is, foreign companies which have decided to set up a plant in the region in order to exploit the regional market.
- *Indigenous large market-orientated firms*, that is, regionally-owned and managed enterprises which have increased their size selling their products in the regional market.

The impact of this model of firm on the regional growth is constrained by the absence of important backward linkages and, especially in final sectors, by the low access to external markets. This weak exporting activity is particularly negative in this type of company whose size doesn't represent a limitation to its penetration into external markets. Therefore, the predominant orientation towards the regional market can be explained in these cases as a result of a low entrepreneurial dynamism or a weak competitive position. Nonetheless, it can play a strategic role in high technological basic and intermediate sectors where it can contribute to increasing productivity through technology spillovers. These productivity impacts of large enterprises on local-owned firms through forward linkages might have been underestimated for a long time, since the attention of policy-makers has focused on backward linkages (DRIFFIELD *et al.*, 2004).

In addition to considering these models separately, it is illuminating to analyse the whole composition of the productive system. This allows us to

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4 detect some strengths and weaknesses of an economy, and to approach, in
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6 some way, the “quality” of entrepreneurial tissue (GUZMÁN *et al.*, 2000;
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8 SANTOS, 2004; ROMERO and SANTOS, 2006). In our hypothesis, regions
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10 with different levels of development are characterized by different enterprise
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12 compositions according to our typology. On the one hand, the competitive and
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14 powerful economies might show an important presence of exporting and
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16 extravert SMEs, and a significant amount of large propelling firms in final
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18 sectors. Furthermore, there can be a dense population of domestic firms,
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20 especially in intermediate sectors, contributing to interconnect the whole
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22 productive system. On the other hand, the dependent and uncompetitive
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24 regions might feature an abundance of dependent SMEs, large market-
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26 orientated firms, especially in final sectors, and large enclave firms in basic or
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28 intermediate sectors, with a very limited impact on the regional economy and a
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30 high risk of delocalization. Although in this article we don’t address the case of
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32 highly-developed regions, you can find some indirect evidence in the literature
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34 with regard to them (KEEBLE, 1997; GUERRIERI *et al.*, 2001;
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36 OBSERVATORY OF EUROPEAN SMEs, 2002; PORTER, 2003). Moreover,
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38 the results for Andalusia –a backward region by Spanish and EU standards-
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40 which we present in Section 5, confirm our hypotheses regarding less
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42 developed regions.
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54 4. FIRM SIZE, REGIONAL LINKAGES AND ENTERPRISE MODELS IN 55 56 ANDALUSIA

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58 In order to illustrate the use of our typology, we will use data from the
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60 input-output table of Andalusia (IEA, 1999). Andalusia is a region with 7.5

million inhabitants located in southern Spain and it is one of the most backward regions in the country and in the EU-15, such as its low GDP per capita, high unemployment rate and high rate of labour in agriculture show (Table 2). According to the size distribution of firms, Andalusia also has other important comparative weaknesses regarding the EU-15 and even Spain. Mainly, as can be seen in Table 3, the percentage of microentreprises is higher than the average of the EU-15 and Spain as a whole and, likewise, the percentage of large firms is lower. Moreover, main activities are low-technological in industry and low knowledge intensive in services in comparison to the EU-15 and Spain.

INSERT TABLE 2 AROUND HERE

INSERT TABLE 3 AROUND HERE

In this section, the empirical objective will be to study the composition of the industrial sector in Andalusia applying the enterprise typology proposed in Section 3 to our data set.

4.1. Data and methodology

The survey made to estimate the input-output table includes, among other variables, information about firms’ purchases and sales. Thus, we could obtain from the Andalusian Statistical Institute data about the value of the total intermediate inputs purchases, classified according to their regional or imported origin, and the value of regional production, classified according to its destination to the regional or external market. Unfortunately, this data does not refer to single establishments, since the Andalusian Statistical Institute is obliged to withhold this information. Hence, we use data aggregated by size

groups –regarding the number of employees- and the sector. This use of the input-output data, as was pointed out in the introduction, represents a novelty, since we do not work with data by sectors, as input-output tables traditionally do, but with data disaggregated into groups of firms *within each sector*. Specifically, we have data for four size groups within each sector, as follows: establishments from 0 to 5 employees; from 6 to 19 employees; from 20 to 49 employees and from 50 and more employees. Nevertheless, for simplicity's sake, we will consider the two intermediate size-groups as a single one. Thus, we distinguish three types of firms according to their size: microenterprises (from 0 to 5 employees), SMEs (from 6 to 49 employees), and large firms (from 50 and more).⁴ The data are available for 29 manufacturing industries.

Various alternative indicators have been proposed to measure the interindustry linkages. Recent overviews of the literature can be found in DIETZENBACHER and LAHR (2001), SÁNCHEZ-CHÓLIZ and DUARTE (2003) or CAI and LEUNG (2004). Although our data allow us to split each column of the input-output table into four, we cannot do the same with the rows.⁵ Consequently, we cannot obtain the Leontief inverse and calculate the indirect effects. Thus, we will only consider the direct effects calculating, for each size group within each sector, the value of two indicators representative of the backward and forward linkages: the ratio of Regional Supplying and ratio of Orientation towards the Regional Market.

- The *ratio of Regional Supplying (RS)* represents, for each size group s in each purchasing sector j , the proportion of regional inputs purchase to total intermediate inputs purchase, as follows:

$$RS_{js} = \frac{\sum_i x_{ijs}^r}{\sum_i x_{ijs}} \quad (1)$$

in which x_{ijs} indicates the value of the output from sector i (including both regional and imported products⁶) purchased by the establishments in s size group within sector j ; whereas x_{ijs}^r exclusively stands for the consumption of inputs produced within the region. This ratio reflects, for each sector, the strength of the regional backward linkages.⁷

This ratio can be interpreted as a weighted average of the RS values obtained in the individual establishments within each sector and size group, as follows:

$$\text{Let us define } IC_{js} \equiv \sum_i x_{ijs} \text{ and } IC_{js}^r \equiv \sum_i x_{ijs}^r \quad (2)$$

$$\text{and also, } IC_{jsk} \equiv \sum_i x_{ijsk} \text{ and } IC_{jsk}^r \equiv \sum_i x_{ijsk}^r \quad (3)$$

where x_{ijsk} indicates the value of the output from sector i (regional and imported) purchased by each k establishment in the s size group and sector j ; whereas x_{ijsk}^r exclusively stands for the consumption of regional inputs. Then,

$$IC_{js} \equiv \sum_k IC_{jsk} \text{ and } IC_{js}^r \equiv \sum_k IC_{jsk}^r, \quad (4)$$

and, from (1), (2) and (4)

$$RS_{js} = \frac{IC_{js}^r}{IC_{js}} = \frac{\sum_k IC_{jsk}^r}{\sum_k IC_{jsk}} = \sum_k \left(\frac{IC_{jsk}^r}{\sum_k IC_{jsk}} \cdot \frac{IC_{jsk}}{IC_{jsk}} \right) = \sum_k \left(RS_{jsk} \cdot \frac{IC_{jsk}}{\sum_k IC_{jsk}} \right) \quad (5)$$

Notice that in (5) the values of RS for each firm k are weighted by the participation of the firm's intermediate purchase in the total input purchase of size group s and sector j .

- *The ratio of Orientation towards the Regional Market (ORM)* represents, for each size group within each sector, the proportion of its production which is sold in the regional market. It is defined as follows:

$$ORM_{js} = 1 - \frac{E_{js}}{X_{js}} \quad (6)$$

in which E_{js} stands for the exportation of sector j products by industrial establishments in the s size group, and X_{js} for the value of the total production of the group. As you can notice, this indicator doesn't make a distinction regarding the intermediate or final character of the production. This differentiation, which would enrich the analysis, can not be applied in practice. The estimation of the exportations in the regional input-output table doesn't allow us to disaggregate the data in this way. Nevertheless, the ratio of Orientation towards the Regional Market approaches the measurement of the forward linkages within the region since it reflects the regional or external orientation of each sector regarding the localization of its markets.

The value of this ratio can also be interpreted as a weighted average of the values obtained in the individual establishments, as follows:

$$\begin{aligned} ORM_{js} &= \frac{X_{js} - E_{js}}{X_{js}} = \frac{\sum_k (X_{jsk} - E_{jsk})}{\sum_k X_{jsk}} = \sum_k \left(\frac{X_{jsk} - E_{jsk}}{\sum_k X_{jsk}} \cdot \frac{X_{jsk}}{X_{jsk}} \right) \\ &= \sum_k \left(ORM_{jsk} \frac{X_{jsk}}{\sum_k X_{jsk}} \right) \end{aligned} \quad (7)$$

where the weights are the shares of each firm in the production of s size group in sector j .

Additionally, we have classified the 28 manufacturing industries according to the two factors considered in Section 3: the position within the value chains and the technological level.

On the one hand, we have approached the firms' situation within the value chains by using as an indicator the ratio of Intermediate Outputs, defined as follows:

$$IO_i = \frac{\sum_j x_{ij}^r}{X_i - E_i} \tag{8}$$

The denominator indicates the value of the regional production which is commercialized within the regional market, and the numerator gives the part of this production that is used as an intermediate input by other sectors in the region. Consequently, a high value for this indicator means the production of the i sector is mainly applied in the regional market as an intermediate input, whereas a low value indicates it for the most part goes to the final demand. More specifically, we consider a sector to be “basic” when the IO ratio is higher than 0.7; “intermediate”, when the IO ratio is between 0.7 and 0.3; and “final”, when the IO ratio is up to 0.3.⁸

On the other hand, we have separated the manufacturing industries into three groups - high-technological, medium-technological and low-technological industries- considering the OECD criteria (OECD, 2005). In this way, we have classified the 28 manufacturing industries in the nine types which appear in Table 1 (the Appendix at the end of the paper shows the whole classification).

Next, we have calculated the ratio of Regional Supply and the ratio of Orientation towards the Regional Market for microenterprises, SMEs and large firms in each of the nine types of industries. Since the values of these ratios in each size-group can be interpreted as a weighted average of the ones obtained in the individual establishments -see (5) and (7) in Section 4.1-, we can identify the most representative model in each size-group within each sector. In order to do that, we have considered the value of 50% for both ratios as a threshold to distinguish the different models of firm behaviour.⁹ Thus, we represent in graphical terms -see Figure 1- the ratio of Regional Supplying on the abscissas axe, the ratio of Orientation towards the Regional Market on the ordinates axe and place the origin of coordinates on the point (50, 50).

4.2. Results

The results are summarized in Table 4, which shows the predominant firm-class in each size-group and type of industry.

INSERT TABLE 4 AROUND HERE

Industrial microenterprises in Andalusia are mainly represented by the model of *domestic firm*, whereas the model of *dependent SME* is the dominant one among the small and medium industrial establishments, and the *large enclave firm* preponderates among large enterprises. These three models are the dominant ones within their own size groups for 5 of the 9 types of sectors. The results remain the same if you consider each size-group as a whole without distinguishing between industries (see Table 5).

INSERT TABLE 5 AROUND HERE

Figure 2 shows the results for basic industries more in detail.¹⁰ Both in the low and high technological basic industries, SMEs and large firms fit into the model of extravert SMEs and enclave enterprises, respectively. This implies they do not have important backward and forward linkages with other firms in the region. Specifically, the absence of strong forward linkages poses a serious limitation for the regional economy, since we are considering industries situated at the beginning of the value chains. This is especially important in the basic high technological sector, which is only represented by the manufacture of basic chemicals. This industry has a considerable presence in the regional economy due to the availability of some mineral materials and the existence of oil refineries which provide them with essential inputs. However, the basic chemical industry doesn't have relevant links with the final chemical industries in the region. In consequence, Andalusia is missing the opportunity of developing a real chemical cluster what would benefit the regional economy.

INSERT FIGURE 2 AROUND HERE

On the other hand, we can appreciate the existence of strong forward linkages in the case of the medium technological industries, characterized by the presence of dependent SMEs and large market-orientated firms which sell their production in the regional market. This group is made up of some industries that supply inputs to the construction sector. Consequently, in this case, a strong construction cluster exists in Andalusia with a capacity to act as

a driving force in the regional economy, as we have pointed out in other works (ROMERO, 2004).

INSERT FIGURE 3 AROUND HERE

Figure 3 shows the results for the intermediate sectors. In this case, important weaknesses are also detected since the large enclave firms and the dependent SMEs are the dominant type in medium and high technological intermediate industries. As a consequence, some potential forward and, especially, backward linkages have not been exploited. This poses a restriction to the capacity of these activities to propel the regional growth and to increase the productive efficiency through pecuniary and technological externalities. On the other hand, the regional economy shows some strength in intermediate low technological industries in which the dominant enterprise models are the large propelling firm and the domestic SMEs. This positive performance can be mainly attributed to some food industries, especially the olive oil manufacturing which is an important exporting activity in Andalusia. These industries also have important backward linkages with the region's agriculture. We have studied these productive chains in the agro-food cluster in more detail in DIETZENBACHER *et. al.* (2005).

INSERT FIGURE 4 AROUND HERE

To end with, let us discuss the results for final industries (see Figure 4). Firstly, we will consider the high technological group, which, in this case, is

formed only by the manufacturing of other chemical products. In this respect, as has been previously said, no relevant backward linkages exist with the basic chemical industry and, consequently, you mainly find dependent SMEs and large enclave firms. Secondly, the medium technological group, which is represented only by the manufacturing of motor vehicles, is characterized by the presence of dependent SMEs and large domestic firms for which Andalusia is the most important sales market. Again, that is not really good news for the regional economy. As these industries are situated at the end of the value chains, there are not many possible forward linkages to develop within the regional economy in these sectors. Thus, a higher exporting ratio in this sector, especially regarding the large enterprises, would have a positive effect on the regional economy so that the potential market for these activities would increase. This consideration is also applicable to the low technological industries, dominated by the presence of domestic SMEs and large market-orientated firms, which in addition do not have important backward linkages with intermediate and basic industries within the regional system. The insufficient presence of exporting SMEs and large propelling firms in these industries, especially in those with a higher technological level, constitutes a weakness of the regional economy. This fact could be attributed to the limitation that size represents for SMEs, but also to the low level of entrepreneurial quality in regionally-owned firms (GUZMÁN and SANTOS, 2001).

5. SUMMARY AND CONCLUSIONS

In this paper, we have introduced a theoretical enterprise typology based on the firm size and the firms' regional linkages which distinguishes seven types

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4 or models of enterprises: the “domestic” firm, the “exporting” SME, the
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6 “dependent” SME, the “extravert” SME, the large “propelling” firm, the large
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8 “enclave” firm, and the large “market-orientated” firm. This typology can be a
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10 powerful tool to analyse the composition of the industrial sector in any region
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12 and to detect the strengths and weaknesses of a regional economy.
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14 Furthermore, we suggest the hypothesis that the industrial sector fits into
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16 different patterns of composition, according to our typology, in regions with
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18 different levels of development.
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23 Regarding this, we have applied our typology in this paper to study
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25 industry in Andalusia, a backward region in southern Spain. Thus, we have
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27 observed the predominance of dependent SMEs and large enclave firms, and
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29 the scarce presence of large propelling firms, exporting SMEs and extravert
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31 SMEs in the regional industry. Both groups of facts reveal the weakness of the
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33 regional industry. In addition to this, we have noticed an excessive orientation
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35 towards the internal market in SMEs and large firms operating in final industries,
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37 which limits the growth potential of the regional economy. Furthermore, the
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39 fragility of the regional industry is accentuated in the high-tech industries. Large
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41 firms in these industries behave as enclaves so that the regional economy
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43 doesn't benefit from the technological spillovers they could originate. This
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45 situation can be explained by the insufficient development of these high-tech
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47 industries in Andalusia, which leads to the absence of efficient regional and
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49 competitive regional suppliers. From this perspective, the case of Andalusia is
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51 an example of a more general pattern that would characterize backward
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53 regions. On the other hand, according to our hypotheses, the competitive and
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55 powerful economies might show an important presence of exporting and
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extravert SMEs, and a significant amount of large propelling firms in final sectors. In addition there can be a dense population of domestic firms, especially in intermediate sectors, contributing to interconnect the whole productive system. Nevertheless, further comparative studies are required to contrast these hypotheses, especially in the case of high development regions. As we show in this paper, the primary data from the survey to estimate regional input-output tables can be a useful statistical source to carry out such empirical analysis.

Finally, it is interesting to point out that our data allowed us to split up the columns of the input-output table considering different size-groups for the establishments in each sector, but we could not do the same for the rows. Therefore, a full specification of the input-output table in size-groups for all the sectors would be very useful to analyse some aspects such as outsourcing or the position of large firms and SMEs in the value chains. That would be another interesting extension of the framework we have proposed in this article to analyse the relationship between firm size and regional linkages.

NOTES

1. PARR *et. al.* (2002) refer to these agglomeration economies derived from productive linkages as ‘activity-complex economies’.
2. The integration of large firms and SMEs within the territory and the performance of industrial clusters are conditioned not only by the presence of regional linkages, but also by the relationship with local and regional governments, households and other private agents. Nevertheless, in this paper,

for the sake of simplicity, we will focus on the productive linkages without considering some other relevant economic and social aspects.

3. The position of the SMEs above and on the right with regard to large firms in Figure 1 is in line with the widespread hypothesis about the relationship between firm size and the strength of regional linkages discussed in Section 2.2. We have also tested these assumptions from our data employing an analysis of variance (ANOVA) from the two indicators of regional linkages which will be introduced in Section 3.1. In this way, we have checked that the higher the size of establishments is, the lower the proportion of regional intermediate inputs in the total intermediate purchases is. Furthermore, the higher the size of establishments is, the lower the proportion of regional production sold in the regional market is (see Table 5). The ANOVA showed that these differences in the spatial patterns of supply and sales are statistically significant.

4. The Andalusian Statistical Institute determined the size-groups, choosing this low threshold -50 employees- for the largest establishments to avoid revealing confidential information. In some industrial branches in Andalusia there are only a few industrial large plants; hence, if the data for large establishments referred to plants with, for instance, more than 250 employees, you could guess from which firm the data came. Therefore, we cannot follow the standard of the OBSERVATORY OF EUROPEAN SMEs (2002), which defines large firms as enterprises with 250 employees or more; the SMEs as those between 10 and 250 employees and the microenterprises as firms with less than 10 employees.

5. The reason is that in the survey made to estimate the table, firms are not asked about the firm size of their clients and suppliers. Thus, we cannot know

which part of the production of each size-group in each sector is purchased by each size-group in each sector.

6. Throughout this paper, the import and export terms refer to purchase and sales outside the region, including the interregional trade within a national economy.

7. We believe this index is more suitable in this case than alternative ones, such as the inputs coefficient proposed by CHENERY-WATANABE (1958). The main advantage of the RS ratio consists in its independence from the proportion of intermediate inputs or primary factors in the value of production, which do affect the value of the Chenery-Watanabe inputs coefficient.

8. This indicator focuses on what occurs within the regional market. We opt to exclude the exported production since we can not distinguish if its destination is final demand (consumption and investment) or intermediate demand by other productive activities

9. In this paper, the terms firm and establishment are both used for simplicity without making any distinction. However, it is convenient to take into account that we use data for establishments, not for firms -which can have more than one establishment.

10. From now on, we will focus on the results for SMEs and large firms because of their greater macroeconomic importance.

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INSERT APPENDIX AFTER THE REFERENCES

Appendix. Classification of manufacturing industries

		Technological level		
		Low technological industries	Medium technological industries	High technological industries
Position within the value chains	Basic industries	Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear Manufacture of wines and alcohol production Manufacture of wood and of products of wood and cork, except furniture Manufacture of paper and paper products	Manufacture of rubber and plastics products Manufacture of cement, lime and plaster Manufacture of clay and ceramic products Manufacture of glass and glass products and other non-metallic mineral products	Manufacture of basic chemicals
	Intermediate industries	Manufacture of vegetable and animal oils and fats Manufacture of other food products Textile manufacturing Publishing, printing and reproduction of recorded media	Metallurgy Manufacture of fabricated metal products Building and repairing of ships and boats Collection, purification and distribution of water	Manufacture of machinery and equipment Manufacture of electrical machinery and apparatus Manufacture of radio, television and communication equipment and apparatus Manufacture of medical, precision and optical instruments, watches and clocks
	Final industries	Production and processing of meat products Processing and tinning of fish and vegetables Manufacture of dairy products Manufacture of bakery products Manufacture of wearing apparel; dressing and dyeing of fur Manufacture of furniture	Manufacture of motor vehicles, trailers and semi-trailers	Manufacture of other chemical products

Source: Elaborated from IEA and OECD.

Figure 1. Enterprise typology according to the spatial patterns of productive linkages

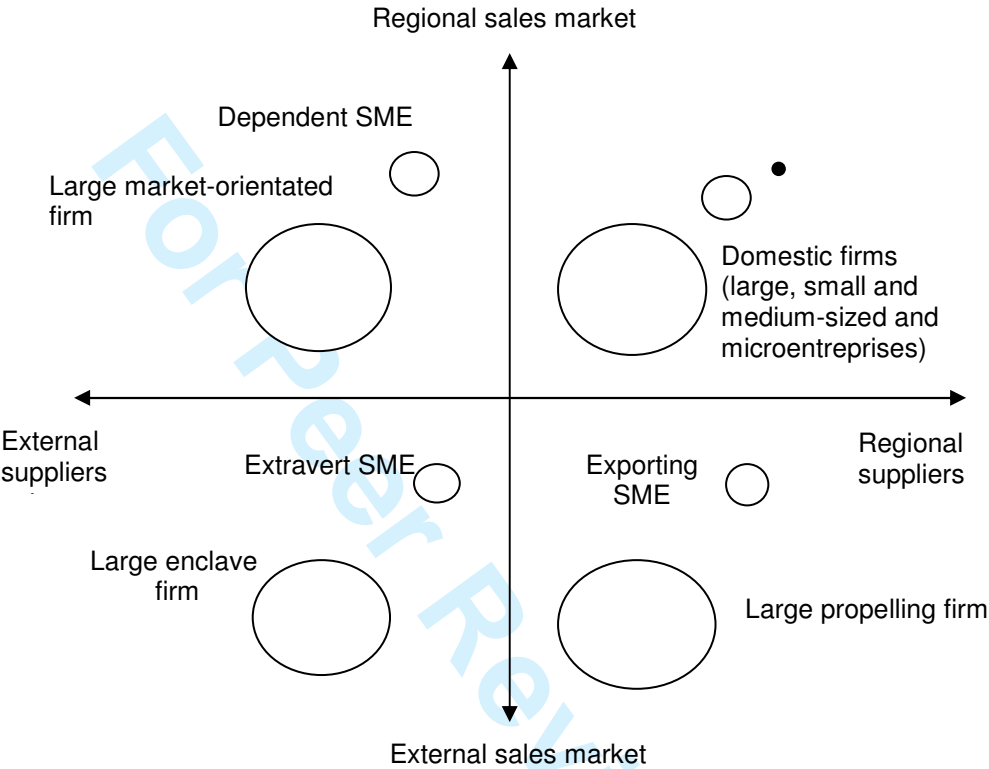


Figure 2. Basic industries: firm size, regional linkages and technological level

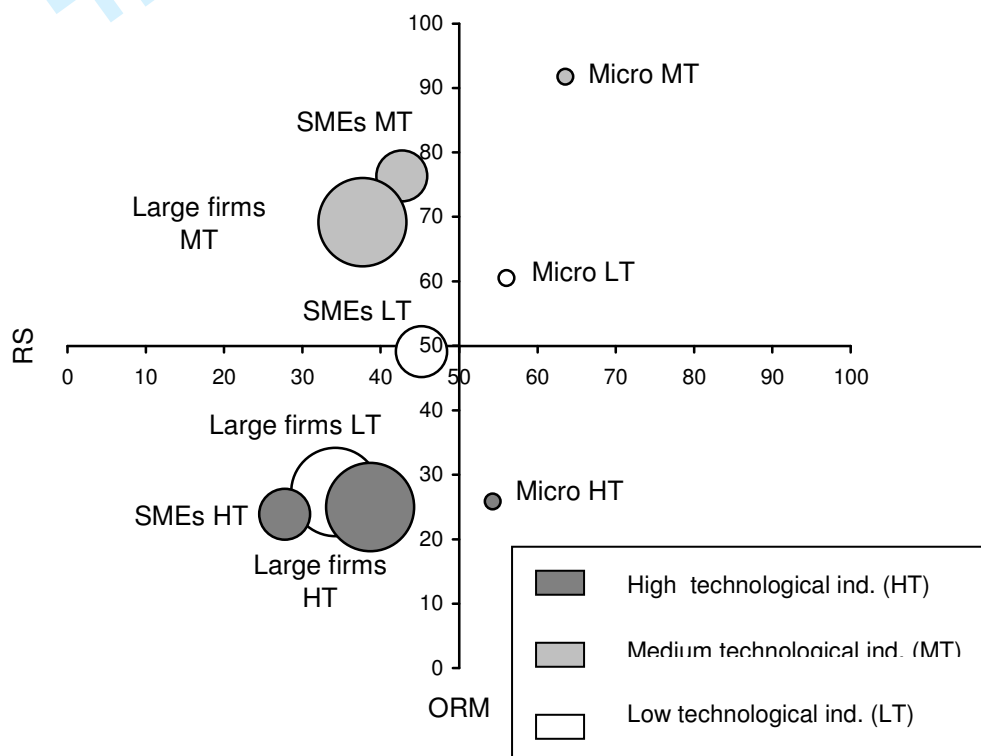


Figure 3. Intermediate industries: firm size, regional linkages and technological

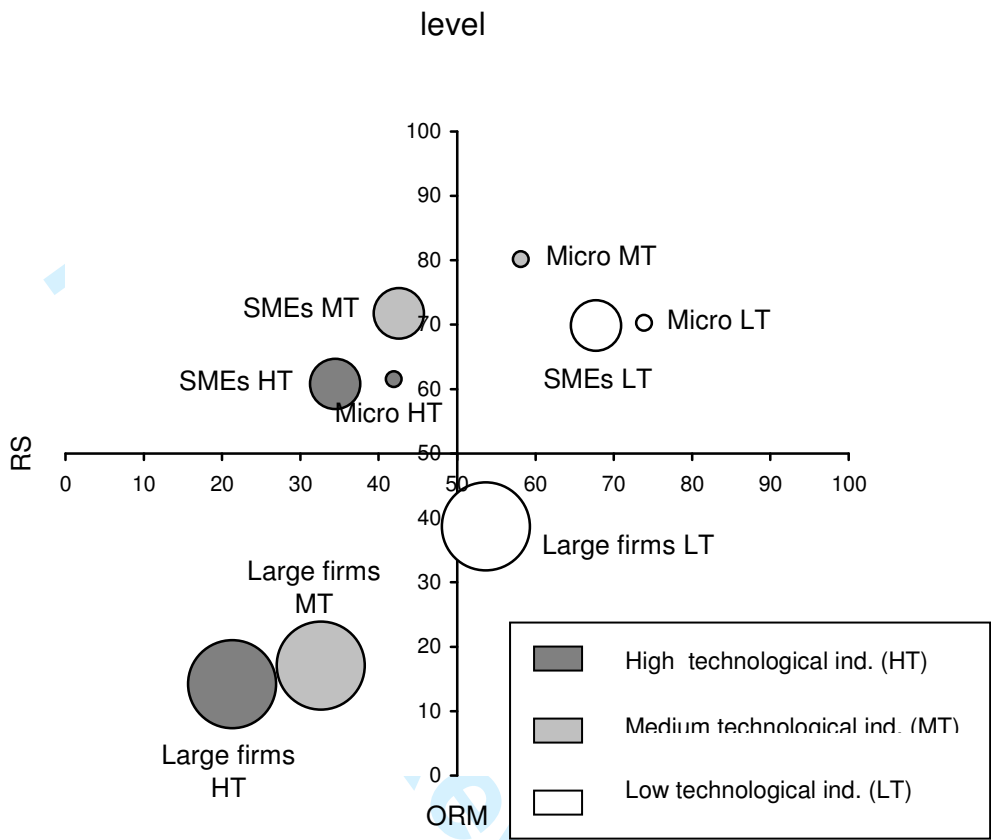
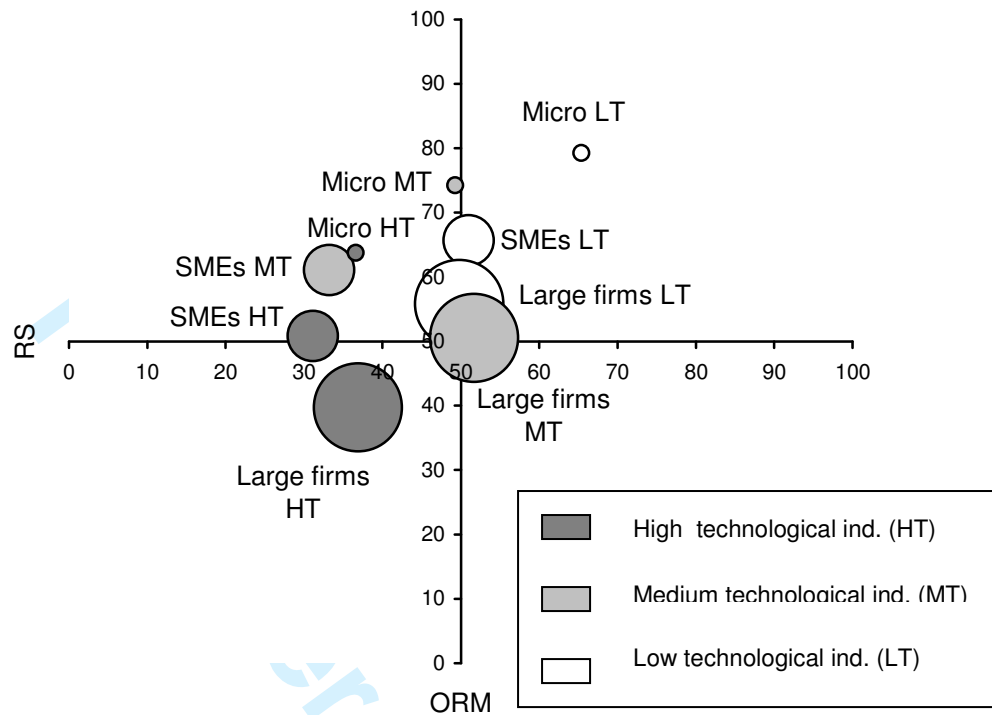


Figure 4. Final industries: firm size, regional linkages and technological level



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Table 1. Sector typology considering main potential externalities

		Technological level		
		Low technological industries	Medium technological industries	High technological industries
Position within the value chains	Basic industries	Strong push effects	Strong push effects Forward technological spillovers	Strong push effects Strong forward technological spillovers
	Intermediate industries	Push and pull effects	Push and pull effects Technological spillovers	Push and pull effects Strong technological spillovers
	Final industries	Strong pull effects	Strong pull effects Backward technological spillovers	Strong pull effects Strong backward technological spillovers

Table 2. Main regional indicators of Andalusia in comparison with the EU-15
and Spain

	GDP p.c. (PPS 2001) EU-15=100	Unemployment Rate 2002	Distribution of labor by sector (%) 2002		
			Agric.	Indus.	Servic.
EU-15	100.0	7.8	4.0	28.2	67.7
Spain	84.2	11.4	5.9	31.2	62.9
Andalusia	64.3	19.6	10.3	25.6	64.1

Source : EUROSTAT

Table 3. Size distribution of firms in Andalusia, Spain and EU-15

		Distribution of firm size (%) 2003			
	N. of firms 2003 (1,000s)	Micro	Small	Medium	Large
EU-15	18,698	92.37	6.47	0.96	0.20
Spain	2,813	93.94	5.17	0.75	0.13
Andalusia	417	94.58	4.74	0.61	0.07

Source: European Observatory for SME and Spanish Observatory for SME

Table 4. Dominant enterprise class in each group

		Technological level		
		Low technological industries	Medium technological industries	High technological industries
Position within the value chains	Basic industries	Domestic microenterprises	Domestic microenterprises	Exporting microenterprises
		Extravert SMEs	Dependent SMEs	Extravert SMEs
		Large enclave firms	Large market-oriented firms	Large enclave firms
	Intermediate industries	Domestic microenterprises	Domestic microenterprises	Dependent microenterprises
		Domestic SMEs	Dependent SMEs	Dependent SMEs
		Large propelling firms	Large enclave firms	Large enclave firms
	Final industries	Domestic microenterprises	Dependent microenterprises	Dependent microenterprises
		Domestic SMEs	Dependent SMEs	Dependent SMEs
		Large market-oriented firms	Large domestic firms	Large enclave firms

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Table 5. Firm-class dominance according to size

Number of employees	RS	ORM	Class dominance
From 0 to 5 emp.	55.24	69.82	Domestic microenterprise
From 6 to 49 emp.	44.86	65.24	Dependent SME
50 and more emp.	37.22	43.11	Large enclave firm